



# Hamilton Institute

## Probabilistic Interaction Networks

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### **Abstract:**

There is a common perception in today's business that the world around us becomes less hierarchical and more networked and "flat". While the shift towards a networked and decentralised business environment generally creates more freedom to act, it does not increase automatically the chances of success. Understanding the dynamics of networked systems – in particular the interplay between the performance of an individual node and of the entire network, and the importance of effective bonding for the well-being of an organisation – becomes a critical skill. Replacing mental models with a formal, quantitative model can improve such understanding and ultimately allow for systematic network optimisation. To this end, we propose to combine stochastic system dynamics modelling of individual nodes with probabilistic graphical modelling of a network configuration. The latter is closely related to theoretical constructs such as the Ising model in statistical mechanics or Markov random fields in image analysis. Modelling of value networks in business turns out to be even more complex because of the random structure of a network. In this talk, we discuss the economic substance and mathematical representation of node-to-node bonds, formulate a general Bayesian solution to the problem of estimating unknown state and parameter values in the resulting model, and discuss its Markov chain Monte Carlo implementation. To illustrate the concepts introduced, we revisit Clayton Christensen's qualitative model of the dynamic behaviour of new entrants versus incumbents when dealing with sustaining and disruptive innovation – and consider its reformulation as a probabilistic interaction network. We conclude by looking outside business for other instances of value networks.

### **Bio:**

Rudolf Kulhavy has been a researcher with the Institute of Information Theory and Automation of the Academy of Sciences of the Czech Republic since 1985 (part-time since 1995). In 1996, he joined Honeywell Laboratories where, two years after, he established a quantitative data analysis group. In 2002, he was appointed Senior Fellow in Honeywell's Automation and Control Solutions strategic business group. In 2004, he moved to IBM Global Services to consult on business modelling and business intelligence solutions, primarily in the financial services sector. In his research, Ruda dealt with diverse topics, including parameter tracking in adaptive control, information geometry of approximate Bayesian estimation, decision support combining memory-based regression and stochastic optimisation with real-time data warehousing, video object classification using 3D deformable templates, and system dynamics modelling of manufacturing systems. His current research interest is in probabilistic modelling of the dynamic behaviour of value networks.

**Venue:** Seminar Room, Hamilton Institute, Rye Hall, NUI Maynooth

**Time:** 2.00 - 3.00pm (followed by tea/coffee)

Travel directions are available at [www.hamilton.ie](http://www.hamilton.ie)

